

## Revised Report

for

### Arranging power supply to cluster of 5 villages of Thovinkere Gram Panchayat on “OFF grid” mode from Kabbigere Biomass Power Plant during schedule/Unschedule grid shut downs/load shedding

Submitted to



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## 1. Introduction

Electrical power plays an important role for overall economical development of the state & country. Providing reliable & quality power is essential for development of industry, agriculture, & service sectors, which are the primary factors for the growth of GDP. The rural population in the country is about 70 % and consumes about 30 % of the energy. This energy requirement is presently being catered from the Hydel, Thermal & Nuclear Generating plants located at far off places from the load centres. There is considerable strain on the network due to remotely located rural loads. The lengthy Transmission & Distribution network including evacuation lines has resulted in high-energy losses, un-reliable & poor quality of power supply and involves huge expenditure in the development of T&D network. The existing generating capacities and T&D network are quite inadequate not only to cater to the existing rural loads but also, to meet the growing rural agricultural loads. Hence projects involving decentralized power generation by non-conventional energy sources like Biomass play an important role in mitigating the above mentioned problems.

## 2. Objective:

The 500 kW Biomass power plant was established near Kabbigere village in Thovinkere Gram Panchayat to achieve the following objectives:

- a) The Project seeks to provide both local & global benefits.
- b) Reduce carbon dioxide emission through the promotion of bio energy as a valuable and sustainable option to meet the rural energy requirement.
- c) To develop and demonstrate a **decentralized bio energy technology** for rural India utilizing the locally available biomass.
- d) Provides reliable & quality power at reasonable price to the rural areas.
- e) To release strain on the State / National grid by providing distribution generation near load centers.

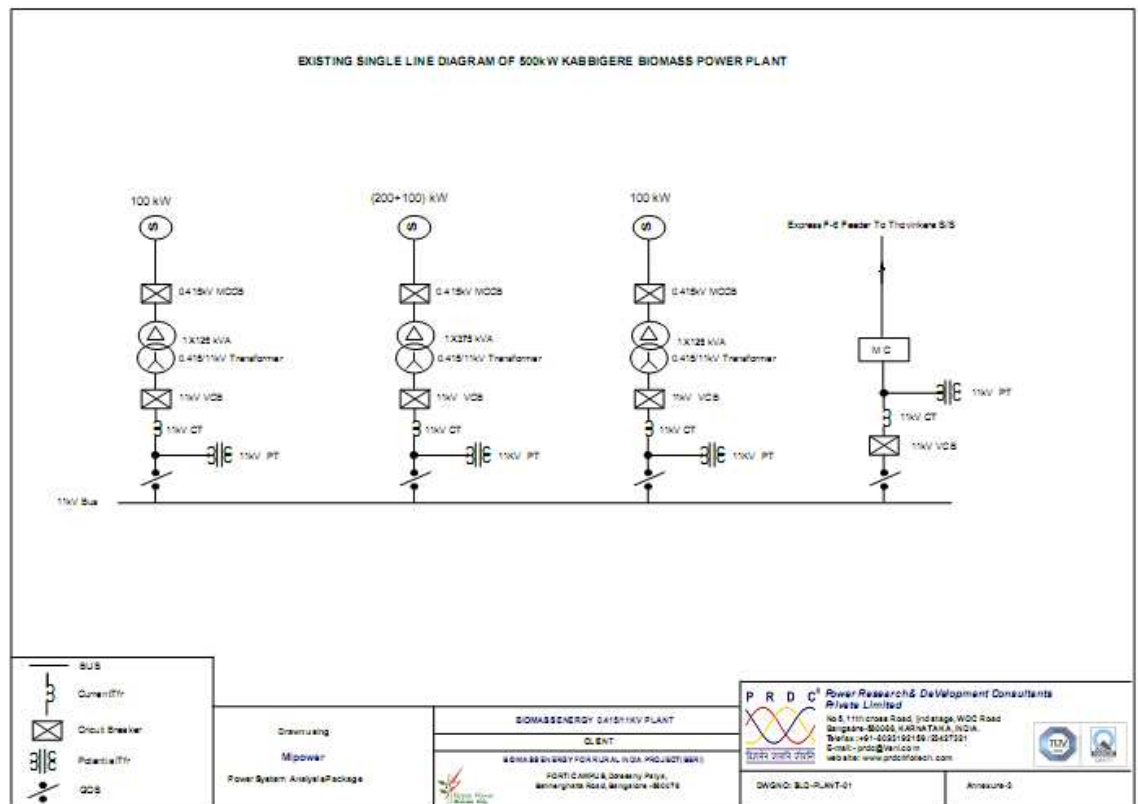
### 3. Project Phase-1:

3.1 The Phase-1 of the project has been completed & commissioned already by:

- a) Establishing the Biomass power generating plant of 500 kW capacity as shown in Table-No 3.1

<b>Table-No 3.1:Details of Biomass power plant Near Kabbigere village Thovinker Gram Panchayat</b>				
<b>SI No</b>	<b>Type of generating plant</b>	<b>Number of units</b>	<b>Capacity of each unit in kW</b>	<b>Total capacity in kW</b>
1	Biomass Gassifier	1	200	200
2	Biomass Gassifier	2	100	200
3	Duel Fuel ( Biomass Gas & Diesel)	1	100	100
<b>4</b>	<b>Total</b>	<b>4</b>		<b>500</b>

- b) Establishing 1X 375 kVA and 2X125 kVA, 11/0.433 kV out door step up Transformer switch yard with associated switch gear etc, as shown in the SLD.



- c) Connecting the Kabbigere Biomass power plant with Thovinkere 66/11 kV Grid substation through F-6, 11 kV express feeder

**4. Existing power supply (feeding) arrangements:**

- a) The power supply to cluster of five villages viz Kabbigere,Chikkanahall, Chikkarasanahalli,Ajjinahalli,&Obenahalli, including domestic, commercial, water supply, small industrial like flour mills, public lighting and irrigation pump sets are catered directly from F-2 feeder of Thovinkere 66/11 kV grid substation as shown in the geographical diagram presented in Annexure-1
- b) The 500 kW Biomass power plant is directly connected to 11 kV bus of Thovinkere substation through one independent 11 kV F-6, express feeder and entire energy generated is being pumped to the grid and there is no provision for directly catering the cluster of five village loads from the Bio mass power plant.

- c) The abstract details of distribution transformers connected on the F-2 feeder catering the cluster of the five villages are furnished in Table No: 4-1.

SI No	DTC capacity in kVA	Number of DTCs	Total capacity in kVA
1	25	46	1150
2	63	4	252
3	100	7	700
4	Total	57	2102

- d) **The connected load:**

- i. The detailed survey has been conducted to assess the connected loads of cluster of five villages for various categories viz domestic, commercial, small Industries like flour mills, public lighting (street lights) and I.P.Sets (the IP set connected load is assumed as 7.5 HP each by assessing the loads of each pump set at random).
- ii. The total assessed connected load of all the villages is 1122.93 kW and the details are furnished in Table No:4.2

SI.No	Village-name	Domestic (No's)	Water supply (No's)	Flour mill (No's)	Street lights (No's)	I.P.sets		Total connected load in kW
						BERI (No's)	BESCOM (No's)	
1	Kabbigere	84	1	1	28	7	17	169
2	Kabbigere & adjacent Gollarahatti	56	1	Nil	21	2	8	72
3	Chikkanahalli	87	Nil	Nil	28	8	30	236.6
4	Obenahalli	18	1	Nil	7	3	18	129.33
5	Ajjenahalli	51	Nil	1	17	3	27	190
6	Ajjenahalli and adjacent Gollarahatti	7	1	Nil	4	1	Nil	13

<b>Table No- 4.2: Details of assessed connected loads - Cluster of 5 Villages</b>								
SI.No	Village-name	Domestic (No's)	Water supply (No's)	Flour mill (No's)	Street lights (No's)	I.P.sets		Total connected load in kW
						BERI (No's)	BESCOM (No's)	
7	Chikkarasanahalli	74	1	1	19	7	25	199
8	Chikkarasanahalli and adjacent Gollarahatti	11	Nil	Nil	9	2	18	114
<b>9</b>	<b>Total Numbers</b>	<b>388</b>	<b>5</b>	<b>3</b>	<b>133</b>	<b>33</b>	<b>143</b>	
<b>10</b>	<b>Total load in kW</b>	<b>81</b>	<b>27</b>	<b>25</b>	<b>5.93</b>	<b>184</b>	<b>800</b>	<b>1122.93</b>
<b>Note- The Load of each I.P.Set is assumed as 7.5 HP after assessing the connected capacities of submergible motors by measuring voltage &amp; current at poles/meter boards at random in all the five villages</b>								

e) **Load growth:**

The past load growth of the area is assessed as 3% per anum, considering the annual energy input to the 11 kV F-2 feeder at the Thovinkere substation during last 3 years. The same annual % load growth is considered for next 5 years and the year wise anticipated peak load is furnished in the table 4-e)

<b>Table No-4 e): Load forecast of the 5 cluster villages</b>		
SI No	Year	Peak load in kW at 3 % CAGR
1	2010-11	1114
2	2011-12	1147
3	2012-13	1182
4	2013-14	1217
5	2014-15	1254
6	2015-16	1291



## 5. Power supply reliability:

- a) Karnataka state is reeling under acute power shortage and to match the supply & demand, the schedule load shedding is resorted apart from unscheduled load shedding during outage of generating units of the grid.
- b) The rural areas are worst affected and the notified daily scheduled power supply is only about 6 Hrs 3 phase power supply & about 6 to 12 Hrs single phase power supply. The power supply hours are further curtailed during several days in the year during outage of generating units of the grid and net work faults.

## 6. Project Phase-II

### 6.1 Objectives:

#### a) The objectives of the phase-II of the project is to:

- i. Provide reliable power supply to domestic, commercial, watersupply, small industrial like flour mills, public lighting and irrigation pump sets of the cluster of 5 villages viz Kabbigere, Chikkanahall, Chikkarasanahalli, Ajjinahalli, &Obenahalli even during schedule and unscheduled load sheddings of the grid by arranging power supply from the 500 kW Kabbigere bio mass power plant on “**off grid mode**”.
- ii. Pumping Biomass Power Plant directly to the grid during Single Phase power supply from the grid to have single phase power supply to the cluster of five villages.

### 6.2 System Modifications:

#### 6.2.1. Available capacity of the Kabbigere Biomass power plant:

- a) The assessed connected load on this F-2 11 kV feeder is about 1123 kW and peak load recorded at the Thovinkere 66/11 kV grid substation is about 1114 kW with 0.85 pf, where as the Kabbigere 500 kW capacity Biomass power plant can cater to the peak load of about 340 kW only considering the following facts:
  - i. One 100 kW Dual Fuel (Biomass Gas & Diesel) unit will not be running due to high HSD cost.
  - ii. Out of remaining 400 kW, there will be auxiliary consumption of about 15% and the net available generation is only about 340 kW, as detailed in the Table No - 6.2.

<b>Table No- 6.2: Exportable capacity of Kabbigere Biomass power plant</b>				
<b>SI No</b>	<b>Type of generating plant</b>	<b>Number of units</b>	<b>Capacity of each unit in kW</b>	<b>Total capacity in kW</b>
1	Biomass Gassifier	1	200	200
2	Biomass Gassifier	2	100	200
3	Duel Fuel ( Biomass Gas & Diesel)	1	100	100
<b>4</b>	<b>Total</b>	<b>4</b>		<b>500</b>
5	Duel Fuel is shut down due to high cost of Diesel	1	100	100
6	Auxiliary consumption at 15 % of the plant capacity			60
<b>7</b>	<b>Net exportable capacity</b>			<b>340</b>

- b) The anticipated peak loads of cluster of five villages during the year 2015-16 is about 1291 kW considering the past load growth of about 3 % per annum as detailed in the table-4 e). Hence the cluster of five village loads to be divided in to four parts to limit the peak load of divided portion to less than 340 kW.

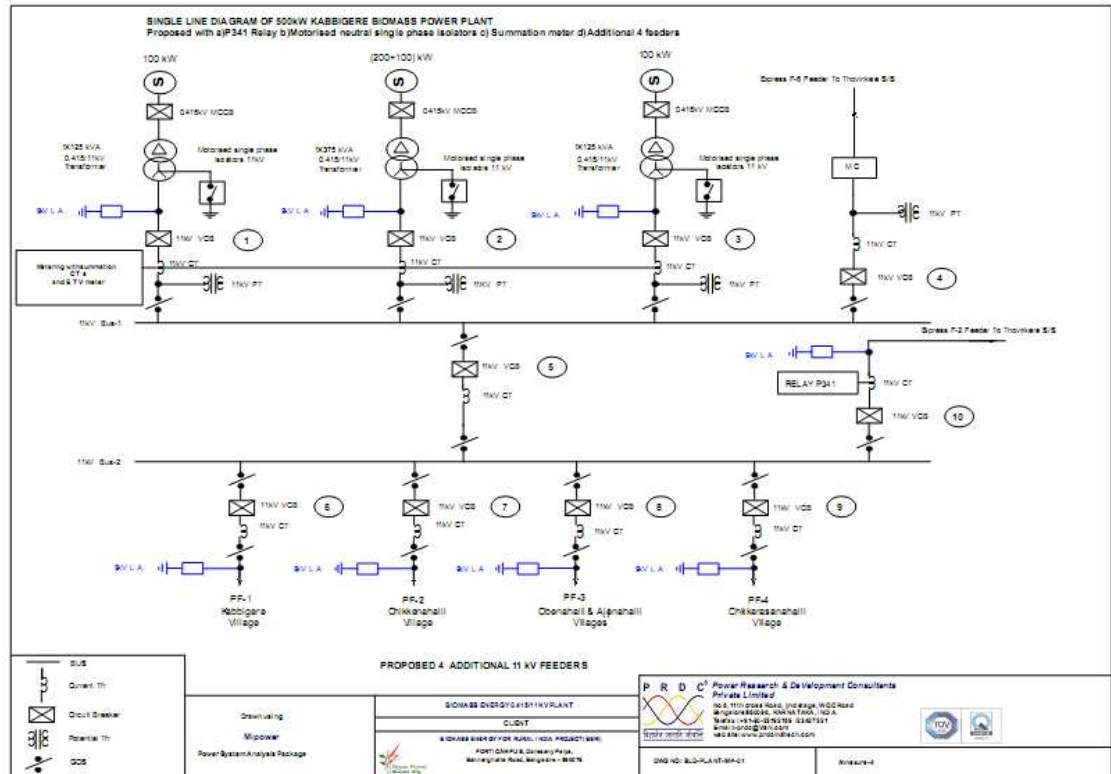
### 6.2.2 Modifications:

The modifications are proposed in the Biomass power plant switch yard and the F-2 feeder to achieve the objectives specified in Para 6.1:

#### 6.2.2.1 Biomass power plant switch yard:

- a) The modifications are to be made in the 11 kV power plant switch yard to have smooth operation under all the following possible conditions:
- i. Normal 3 Ph power supply was available from the grid
  - ii. Failure of 3-Phase power supply from the grid:
  - iii. Single Phase power supply from the grid.
- b) **Details of modifications:**
- i. Formation of additional 11 kV bus No-2 in addition to the existing 11 kV bus N0-1 as shown in the SLD.
  - ii. Formation of ten pole structure to accommodate five numbers of 11 kV bays, four for additional 4 No's 11 kV feeders PF-1,PF-2,PF-

- 3 & PF-4 to cater the cluster of five villages and one for additional F-2, 11 kV express power incoming feeder from Thovinkere substation.
- iii. Providing additional 6 Numbers of outdoor 11 kV PC VC breaker & associated CTs & PTs as shown in the SLD, one for bus coupler between two 11 kV Buses, four for five cluster village feeders and one for additional F-2, 11 kV incoming express feeder from Thovinkere substation. as shown in the SLD



**6.2.2.2 P-341 relay for islanding scheme:**

- a) Providing one P341 relay in the CT circuit of additional F-2 feeder in order to have the following automatic arrangement (achieve the following programming logic by providing the **P341 relay**) to island the Biomass power plant with the feeding arrangements to cluster of 5 village loads during scheduled / unscheduled shedding of the grid power supply without shut down of the Biomass power plant:

**i. To sense the failure of 11 kV grid supply from the grid and to:**

- Trip the 11 kV Breaker No-10 of additional incomer 11 kV F-2 express feeder from Thovinkere 66/11 kV grid substation.
- Trip the three 11 kV breaker No's 7, 8 & 9, out of the four provided at the Biomass power plant outdoor switch yard for the outgoing 11 kV feeders of PF-2, PF-3 & PF-4 to facilitate the Biomass power plant to cater only feeder No-PF-1 in order to limit the load to less than the capacity of the Biomass power plant.
- Automatically close the isolators between the neutral terminals of the power plant transformer to ground, while supplying the 5 cluster village loads from the Biomass power plant in "**off grid mode**" in order to have earth fault protection to the PF-1, PF-2, PF-3, & PF-4 feeders.

**ii. To sense the restoration of the 11 kV grid supply from the grid and to:**

- Automatically open the isolators between the neutral terminals of the power plant transformer to ground while the biomass power plant is connected with the grid supply
- Close the 11 kV breaker No-10 of additional incomer 11 kV F-2 express feeder from Thovinkere 66/11 kV grid substation in order to connect the grid supply to 11 kV Bus No-2.
- Close all the remaining 3 No's out of 4 No's of 11 kV breakers PF-1, PF-2, PF-3 & PF-4 to facilitate the power supply to all the 5 cluster villages.

**6.2.2.3. Open Delta measurement relay:**

- a) The BESCO is providing only single phase power supply, by operating roaster isolator for rural feeders (Opening one phase from source and shorting that phase with other charged phase beyond roaster isolator) to prevent 3 Ph consumers (I.P.sets & other power consumers) to use

power for about 4 hrs in a day during peak period and to allow only S-Ph consumers to use the power mainly for lighting purpose in order to limit the peak load on the system.

- b) The Biomass power plant generators can not be synchronised to such single phase system of the grid.
- c) Hence it is proposed to Provide one open delta measurement relay in the PT circuit of additional F-2 feeder at the 11 kV switch yard to:

**i. sensing the single phase power supply from the grid and to :**

- Trip the 11 kV Bus coupler Breaker Number – 5 in order to isolate the Biomass power plant from the single phase power supply of the grid in F-2 feeder.
- Close the 11 kV Breaker No-4, of F-6 feeder to pump the Biomass power to the Thovinkere 11 kV Bus through the F-6 express feeder.
- Open the motorised 11 kV single pole Isolators provided to the neutral earthing of the 11 kV step up transformers, to isolate the neutral from the ground, to prevent / avoid circulatory currents.

**6.2.2.4. Motorised 11 kV single pole isolators between the neutral terminal of the transformer and ground:**

- a) The 11 kV star secondary of the 12.5 MVA 66/11 kV power transformer is grounded at 66/11 kV Thovinkere substation.
- b) The Biomass power plant generator transformer winding is star connected on 11 kV.
- c) To avoid/prevent the circulating current, the 11 kV neutral to ground of the step up transformers at Biomass power plant is kept open during existing normal operation time of:
  - i. Biomass power supply is directly fed to the 11 kV bus of Thovinkere 66/11 kV substation through 11 kV express feeder.

- ii. The five cluster village **single phase** loads are directly fed from the grid through F-2, 11 kV express feeder from the Thovinkere 66/11 kV substation.
- d) However, in the proposed system, when the grid supply is not present (during scheduled & unscheduled load shedding from the grid) and the Biomass power plant supplies the power to local loads in the off grid mode, 11kV system becomes un-grounded and hence the earth fault protection will not act and isolate the faults.
- e) To mitigate this problem, it is proposed to install 3 numbers of motorised 11 kV isolators between earth terminal at each Biomass power plant generator transformers neutral on 11 kV side & ground to facilitate:
- i. Automatically closing the isolators between the neutral terminals of the power plant transformer to ground by sensing grid failure, while supplying the 5 cluster village loads from the Biomass power plant in “**off grid mode**”.
  - ii. Automatically opening of the motorised 11 kV single pole Isolators when the grid supply is restored/available to isolate the neutral from the ground, to prevent / avoid circulatory currents.

#### **6.2.2.5. Modifications to existing 11 kV F-2 Feeder:**

The following modifications are proposed for the 11 kV F-2 feeders by suitably dividing it to four portions viz PF-1, PF-2, PF-3, & PF-4 and connecting them to 11 kV Biomass power plant Bus No-2, to have connected load & peak load within about 340 kW on each of the four divided portions of the 11 kV feeders. The Geographical diagram showing all the modifications are presented in **Annexure-2**

##### **a) Formation of New 11 kV feeder No-PF-1:**

- i. Disconnecting the F-2 11kV feeder between pole No's P-85 & P-84.
- ii. Disconnecting the F-2 11 kV feeder and between pole NOs P-159 & 158.
- iii. Disconnecting the line between pole NOs P-211 & P-212

- iv. Connecting pole NO P-155 to the Biomass 11 kV Bus No-2 through 11 kV breaker No-6, by extending 11 kV over head line with rabbit ACSR conductor for a distance of about 203 Metres.
- v. Connecting pole NOs P-127 & P-229 by extending 11 kV over head line with rabbit ACSR conductor for a distance of about 346 Metres to take up the loads of 6 DTCs on PF-1 feeder.
- vi. Connecting pole No's P-136 & P-397 by extending 11 kV over head line with rabbit ACSR conductor for a distance of about 280 Metres to take up the loads of 3 DTCs on PF-1 feeder.

**b) Formation of New 11 kV feeder No-PF-2:**

- i. Disconnecting the F-2 feeder between pole NOs P-376 & P-394.
- ii. Disconnecting the F-2 feeder between pole NOs P-337 & P-338
- iii. Connecting P-338 to the Bio mass power plant 11 kV Bus NO-2 through 11 kV Breaker No-7, by extending the 11 kV over head line with Rabbit ACSR conductor for a distance of about of about 300 Metres

**c) Formation of New 11 kV feeder No-PF-3**

- i. Disconnecting the F-2 11 kV line between pole NOs P-189 & P-188
- ii. Connecting pole NO P-159 to the Bio mass power plant 11 kV Bus NO-2 through 11 kV Breaker No-8, by extending the 11 kV over head line with Rabbit ACSR conductor for a distance of about of about 340 Metres

**d) Formation of New 11 kV feeder No-PF-4**

- i. Connecting pole NO P-189 to the Biomass 11 kV Bus No-2, through 11 kV Breaker No-9, by extending 11 kV over head line with rabbit ACSR conductor for a distance of about 1720 metres

**e) Extending the 11 kV F-2 feeder to the Bio mass power plant bus:**

- i. The 11 kV F-2 feeder from Thovinkere substation is proposed to be disconnected between the pole NOs P-85 & P-84 to facilitate the formation new PF-1 feeder from Biomass power plant 11 kV Bus-No-2 as detailed in Para 6.2.2.4 a).

- ii. It is proposed to extend this line from pole NO-P-84 to Biomass Power plant Bus No-2, through 11 kV Breaker No-10, by extending the 11 kV over head line with Rabbit ACSR conductor for a distance of about of about 1620 Metres.
- iii. This additional 11 kV F-2 feeder to Bio mass power Plant 11 kV Bus No-2, is required to Isolate the Biomass power plant with the four 11 kV feeders PF-1,PF-2,PF-3 & PF-4 catering the cluster of five village loads during single phase operation of the Grid power by **“switching OFF”** the Bus coupler Breaker No-5,and to facilitate the pumping of Biomass power to the Grid through F-6 feeder during single phase operation of the rural area loads.

**f) Requirement of additional 11 kV line for modifications and alterations:**

The additional 5.0 kM of 11 kV line to be drawn for the modifications & alterations. The consolidated statement of additional 11 kV line to be drawn for the above purposes is furnished in the table 6.2.2.5.f)

<b>Table No-6.2.2.5 f): Requirement of 11 kV line extension</b>		
<b>SI No</b>	<b>Particulars of 11 kV line extension</b>	<b>Length in Meters</b>
1	Formation of Feeder PF-1	
a)	Connecting from Pole NO-155 to Power plant Bus	203
b)	Connecting the line between Pole NOs127 & 229	346
2	Formation of Feeder PF-2	
a)	Connecting from Pole NO-338 to Power plant Bus	300
3	Formation of Feeder PF-3	
a)	Connecting from Pole NO-159 to Power plant Bus	340
4	Formation of Feeder PF-4	
a)	Connecting from Pole NO-189 to Power plant Bus	1720
5	Extending the 11 kV F-2 feeder to the Bio mass power plant bus	
a)	Connecting from Pole NO-85 to Power plant Bus	1620



<b>7</b>	<b>Total</b>	<b>4529</b>
<b>8</b>	<b>Total line length requirement with 10 % extra for deviations for avoiding way leave problems &amp; rounding off</b>	<b>5000</b>

#### **6.2.2.6. Tariff Metering arrangement for the Biomass power plant:**

- a) As per the existing system arrangement, all the power generated at the Kabbigere Biomass power plant is being pumped to the 11 kV bus of 66/11 kV Thovinkere substation through F-6, 11 kV express feeder and the pumped energy is measured in the metering cubicle provided to the 11 kV express feeder at the Bio Mass power Plant outdoor switch yard.
- b) With the proposed modifications, in view of catering the cluster of 5 villages on “**OFF grid mode**” during the scheduled & unscheduled load shedding, the Biomass power plant will be catering directly to sthe cluster of 5 villages from the Biomass power plant outdoor switch yard which has no metering arrangements at present, and the existing metering cubicle will not record the energy exported to the BESCO consumers of cluster of 5 villages through PF-1,PF-2,PF-3 & PF-4 feeders.
- c) Hence following proposals are made for the metering arrangements at the Kabbigere Biomass power plant outdoor switch yard:
  - i. The existing 11 kV metering cubicle provided to F-6 Feeder at Biomass power plant will not be required.
  - ii. Separate metering arrangements will be made with summation CTs to the existing metering cores available at the 11 kV switch gear No-1,2 & 3 of step up transformers and 0.2 class accuracy ETV meter having following provisions housed in a tamper proof box with necessary sealing arrangements:
    - Billing data.
    - Tamper data.
    - Load survey data

- Memory of 35 days half hourly load survey, billing & tamper parameters.
  - RS 232 communication port for down loading the stored data from the meter
- d) The proposed metering arrangements will record all the exported energy from the power plant to BESCO excluding the power plant auxiliary consumption.
- e) This metering arrangement will be used for billing purpose from BERIS to BESCO.

#### **6.2.2.7. Providing Lightning / surge arrestors in switch yard:**

- a) The 3 Numbers of 11/0.4 kV step up transformers and the 11 kV F-6 incomer feeder from Thovinkere substation are not provided with L.As at the Biomass power plant switch yard.
- b) Hence it is proposed to provide 4 sets of 9 kV,5 kA LAs on the 11 kV side of step up transformers and to 11 kV F-6 incoming feeder at the Biomass power plant switch yard.

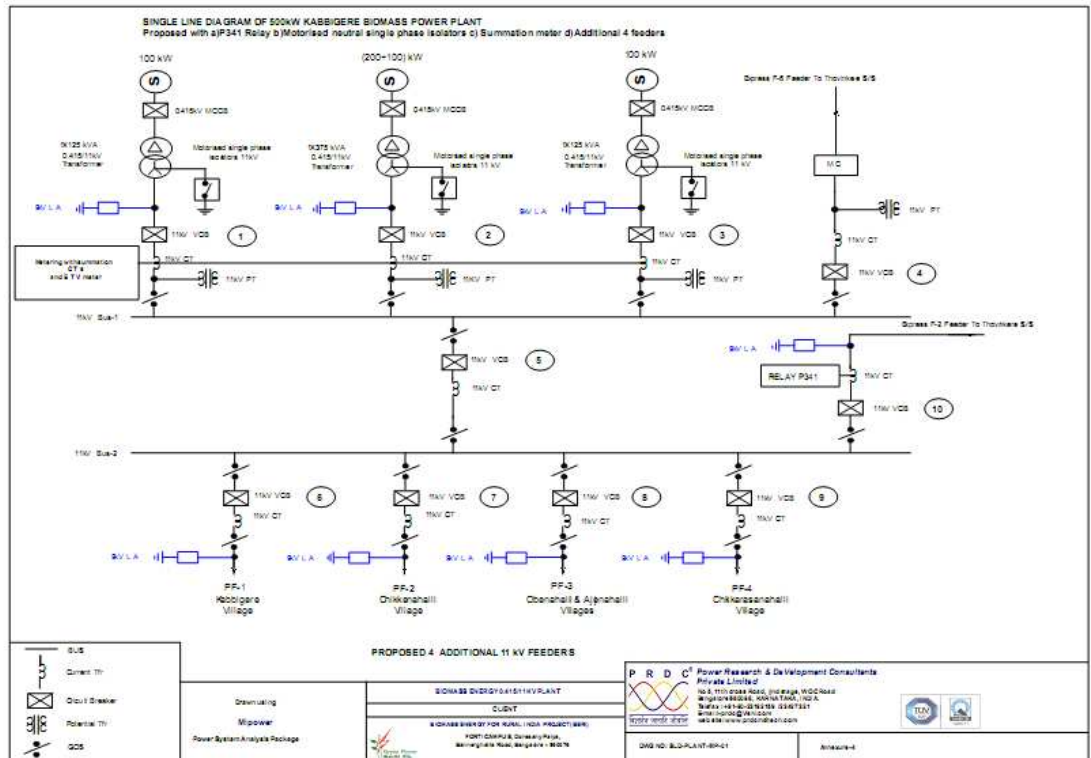
#### **6.2.2.8. Reconfiguration of 11 kV switch gear at 2X12.5 MVA 66/11 kV**

##### **Thovinkere grid substation:**

- a) The following two 11 kV feeders are clubbed together and connected to one 11 kV switch gear at the grid substation:
- i. F-6 - 11 kV express feeder to Biomass power plant
  - ii. F-8 Thovinkere town feeder
- b) There is an idle 11 kV breaker on Bank No-1 in between F-10 & F-2 feeders.
- c) The F-6 Thovinkere express feeder can be connected to idle 11 kV switch gear of Bank -1 to make the F-6 feeder independently controlled by one 11 kV switch gear to facilitate smooth operation of the proposed Biomass power plant Phase – II program.

#### **6.3. Feeder arrangements and feeder configuration after the proposed modifications.**

a) The proposed arrangements at the Bio mass power plant 11 kV switch yard is furnished in the below SLD diagram:



b) The following feeders will be connected to 11 kV Bus No-1 of Biomass power plant:

- a. Biomass power generating units through 3 No's of step up 11/0.433 kV Transformers and 11 kV Breaker NOs 1, 2, & 3.
- b. The F-6, 11 kV express feeder from 66/11 kV Thovinkere substation through 11 kV Breaker No-4.

c) The following feeders will be connected to 11 kV Bus No-2 of Biomass power plant:

- i. The 4 No's proposed 11 kV feeders PF-1,PF-2,PF-3, & PF-4 catering the cluster of 5 village loads through 11 kV Breaker NOs 6,7,8 & 9.
- ii. The 11 kV F-2 feeder from Thovinkere substation through 11 Breaker No-10.

**d) The 11 kV Bus coupler Breaker.**

11 kV Bus No-1 & Bus No-2 will be coupled through Bus coupler Breaker NO-5 .

**e) Four Feeders –PF-1,PF-2,PF-3 & PF-4:**

- i. The 4 numbers of 11KV Feeders catering the cluster of five villages are as shown in the Geographical diagram Annexure – 2.
- ii. The details of connected number of DTCs with capacities on each of the four feeders PF-1,PF-2,PF-3 & PF-4 are furnished in the Table 6.3 d)

<b>Table No-6.3 d) : Feeding arrangements and feeder configuration</b>					
SI No	Feeder Number from Biomass power plant	Areas to be catered	Number of DTCs	Total connected capacity of DTCs in kVA	Total connected Load in kW after 5 years with 3 % annual load growth
1	PF-1	Kabbigere & Gollarahatti Villkages	18	601	<b>328</b>
2	PF-2	Chikkenahalli village	12	413	<b>310</b>
3	PF-3	Obenahalli & Ajjinahalli	15	563	<b>338</b>
4	PF-4	Chikkarasanahall	12	525	<b>315</b>
<b>5</b>	<b>Total</b>		<b>57</b>	<b>2102</b>	<b>1291</b>

**7. Power supply arrangements after modification as per Phase -II.**

- a) The peak load / connected load of all the five villages is about 1123 KWs and the peak load / connected load of the proposed 4 feeders are ranging from 310 kW to 338 kW after 5 years with the annual load growth of about 3% as shown in the table No-6.3 d).
- b) The plant capacity is only 400 kW since one 100 kW unit of Dual Fuel (Biomass Gas & Diesel) is normally not in operation due to high cost of HSD.

- c) The deliverable power is only about 340 kW with about 60 kW of auxiliary consumption.
- d) Hence the plant can cater to the any one of the proposed PF-1, PF-2, PF-3 & PF-4 feeders at a time during grid shut downs.
- e) During the period of grid power supply is "ON" all the four 11 kV feeders PF-1 to PF-4 from the power plant bus will be switched "ON" and complete loads of the 5 villages will be catered.
- f) During the grid shut down period only one feeder of the four 11 kV feeders PF-1 to PF-4 will be switched "ON" on rotation basis & supplied with power keeping the other 3 feeders switched "OFF".
- g) The additional power supply to an extent of about 2 hours each to the 4 feeders will be provided in rotation during 8 hours grid supply failure due to scheduled / unscheduled load shedding period from the Biomass power plant on off grid mode.
- h) The 11 kV bus coupler Breaker No-5 will be switched off during the single phase operation of the F-2 feeder from the grid and Bio mass power plant will be isolated from the village loads and generated power will be exported/pumped to the Thovinkere substation by closing F-6 feeder Breaker No- 4, at switch yard.

## **8. Reduction of system losses:**

- a) As per the existing system conditions, the complete loads of five cluster villages are directly feeding from Thovinkere 66/11 kV substation which about 6.5 KM from the Biomass power plant, through 11 kV F-2 feeder. The Bio mass power plant is located in the load center of cluster of five villages. The peak load of this feeder is about 1114 kW. The Biomass power to an extent of about 340 kW is directly pumped to Thovinkere substation for a distance about 6.5 KM through an independent 11 kV F-6 feeder. The peak power losses & annual energy losses on 11 kV line systems are 71 kW and 71370 kWhrs respectively.
- b) As per the proposed system conditions, out of the system peak load of 1114 kW, 340 kW will be directly fed from biomass power plant and remaining 774 kW will be catered from Thovinkere substation and there will not be any power flow from Biomass power plant to Thovinkere substation under normal

circumstances. The peak power losses & annual energy losses on 11 kV line system will be 44 kW and 44229 kWhrs respectively.

- c) Thus there will be reduction of 27 kW & 27141 kWhrs in peak power losses & annual energy losses on 11 kV line system respectively. The details are furnished in the table No-8.0.

**Table No-8: Statement showing the reduction of peak power losses and annual energy losses in 11 kV system only by execution the proposed Phase-II program works at Kabbigere Bio Mass Power Plant**

SI No	Power supply details	Peak load in kW	LF	LLF	Peak power loss in KW	Annual energy losses in kWhr
<b>1</b>	<b>With the existing feeding condition</b>					
a)	All the 5 village loads feeding directly from the to Thovinkere substation through F-2 feeder	1114	0.3	0.153	65	65339
b)	Biomass power plant power is pumped to Thovinakere substation through F-6 feeder	340	0.3	0.153	6	6031
<b>2</b>	<b>Total existing condition losses</b>				<b>71</b>	<b>71370</b>
<b>3</b>	<b>After proposed modifications as per Phase-II program of BERIS</b>					
a)	Disconnecting the F-2 feeder from the Thovinkere substation and reconfigure the line to have four parts PF-, PF-2, PF-3 & PF-4 and connecting to Biomass power plant 11 kV Bus with 340 KWs generation from Bio mass power plant power plant	<b>340</b>	<b>0.3</b>	<b>0.153</b>	<b>44</b>	<b>44229</b>
b)	Remaining power requirement of 774 KW from Thovinkere substation through F-6 express feeder to Bio mass power plant Bus	<b>774</b>				
<b>5</b>	<b>Net reduction of Losses in 11 kV system only (The L.T Line &amp; DTC losses will remain same)</b>				<b>27</b>	<b>27141</b>

## 9. Cost Estimates:

The total cost for Phase-II works of Kabbigere Biomass power plant as proposed in Para number 6.0 will be about Rs 45.50 Lakhs and details are furnished in the Table No-9

Table NO - 9: Cost Estimate for Phase-II program Kabbigere Bio mass Power Plant							
SL NO	Particulars	Unit	Qty	Material cost		Erection charges	
				Unit Rate in Rs	Amount in Rs	Unit Rate in Rs	Amount in Rs
<b>1</b>	<b>11 kV DPs for terminating five additional 11 kV feeders</b>						
a)	RCC poles 9.5 Mtr long	NOs	12	5755	69060	536	6432
b)	DP sets	Set	10	2416	24160	242	2420
<b>c)</b>	<b>Bus Formation</b>						
i	Rabbit ACSR conductor	Mtr	100	23.9	2390	1.4	140
ii	45 kN Disc Insulators	NOs	66	245	16170	25	1650
iii	C -Type wedge connectors Rabbit to Rabbit	NOs	54	170	9180	25	1350
<b>3</b>	<b>11 kV isolators 200 Amps single break</b>	NOs	12	5067	60804	222	2664
<b>4</b>	<b>Lightning Arrestors 9 kV 5 KA, polymeric</b>	NOs	27	1026	27702	103	2781
<b>5</b>	<b>11 kV outdoor switch gear for four outgoing feeders, one incoming feeder and one Bus coupler</b>						
a)	Porcelain clad Switch Gear 11 kV, 630 Amps, 25 KA with set of CTs & PTs, Protection relays, indoor indicator & control panel	NOs	6	300000	1800000	50000	300000
b)	Foundations for the switch gear	NOs	6	25000	150000	5000	30000

c)	Control Cables from Switch gear to indoor indicator & control panels	Mtrs	900	30	27000	6	5400
5	<b>11 kV over head line for reconfiguration on 9.0 Meters RCC poles with Rabbit ACSR conductor</b>	KM	5	186396	931980	25642	128210
6	<b>Relay P341 for islanding purpose</b>	NOs	1	500000	500000		
a)	Panel Board with control arrangements	NOs	1	50000	50000		
b)	Control cables from Switch gear to control panels	Mtrs	800	30	24000	6	4800
c)	Cable duct formation etc	L/s			50000		5000
7	<b>Open Delta measurement relay</b>	NOs	1	50000	50000		
8	<b>Motorised 11 kV single pole Isolators between the neutral Terminal of the Transformer and ground</b>	NOs	3	25000	75000	2500	7500
a)	Mounting Box for housing Motor operated Isolator & Marshalling Boxes including foundation & Masonry works, control wiring etc	NOs	3	10000	30000	1000	3000
9	<b>Metering arrangement with summation CTs , ETV meter &amp; Tamper proof Box with associated wiring materials etc</b>						
a)	Electronic Tri-Vector Meter 1 A, Class-0.2 accuracy with memory of 35 days Half Hrly Billing ,Load survey and Tamper parameters	NOs	1	12500	12500	1250	1250
b)	Summation CTs Class of accuracy-0.2	NOs	3	2500	7500	250	750



c)	Tamper proof Metering box for housing ETV Meter with Summation CTs including wiring etc	NOs	1	4723	4723	472	472
<b>10</b>	<b>Sub Total</b>				<b>3922169</b>		<b>503819</b>
<b>11</b>	<b>Contingencies &amp; unforeseen at 3 % on total and rounding off</b>				124012		
<b>12</b>	<b>Total cost in Rs</b>				<b>4046181</b>		<b>503819</b>
	<b>Total cost including erection charges in Rs</b>				<b>4550000</b>		
	<b>Total cost including erection charges in Rs Lakhs</b>				<b>45.50</b>		